Name: Key Period: _____ Date: _____

Honors Chemical Reactions Study Guide

Topics Assessed

- Law of conservation of matter/balancing equations
- Types of chemical reactions
- Reactants vs. products
- Predicting the products of chemical reactions
- Use the activity series to determine if a reaction will occur
- Predict solubility of products
- Exothermic vs. endothermic reactions
- Factors that affect reaction rate
- Redox reactions

Part 1: Chemical Equations

$Ca + HNO_3 \rightarrow$

a. Type of reaction: SR
b. Predict the products
c. Balance the equation
d. Determine the solubility of each new compound
e. Identify which element is oxidized and reduced

Oxidized: Ca Reduced: H

FINAL EQUATION: $Ca + 2HNO_3 \rightarrow Ca(NO_3)_{2(aq)} + H_2$

Part 2: Fill-in-the-Blank

Adding a catalyst increases the rate of a reaction by lowering a reaction's activation energy.

Part 3: Multiple Choice

Part 4: Short Answer (including questions about graphs)

Balancing Equations Quiz

Balance the following equations.

1. $\_3\_ H_2 + \_2\_ P \rightarrow \_2\_ PH_3$

H:	H:
P:	P:

Final equation:

2. $\_2\_ Ti_2O_3 + \_3\_ C \rightarrow \_4\_ Ti + \_3\_ CO_2$

Ti:	Ti:
O:	O:
C:	C:

Final equation:

3. $\_\_\_\_ C_2H_4 + \_3\_ O_2 \rightarrow \_2\_ CO_2 + \_2\_ H_2O$

C:	C:
H:	H:
O:	O:

Final equation:

4. _____Na_2SO_4 + _____$CaCl_2$ → _____$CaSO_4$+ 2 NaCl

Na:	Na:
SO_4:	SO_4:
Ca:	Ca:
Cl:	Cl:

Final equation:

5. 2 ReF_5 + 10 HCl → _____Re_2Cl_{10} + 10 HF

Re:	Re:
F:	F:
H:	H:
Cl:	Cl:

Final equation:

Quiz: Predicting the Products of Chemical Reactions

Directions: Predict the products of the following reactions. For double replacement reactions, determine each product's solubility.

1. $HCl + Na \rightarrow$ $NaCl + H_2$
2. $K_2O \rightarrow$ $K + O_2$
3. $C_2H_6 + O_2 \rightarrow$ $CO_2 + H_2O$
4. $Fe(OH)_2 + AgF_4 \rightarrow$ $FeF_{2\,(aq)} + Ag(OH)_{4\,(s)}$
5. $MgCl_2 + Ga \rightarrow$ NR
6. $Al + SO_4 \rightarrow$ $Al_2(SO_4)_3$
7. $PBr_3 \rightarrow$ $P + Br_2$
8. $Li_3PO_4 \rightarrow$ $Li + PO_4$
9. $C_3H_8 + O_2 \rightarrow$ $CO_2 + H_2O$
10. $Na_2S + K_3PO_4 \rightarrow$ $Na_3PO_{4\,(aq)} + K_2S_{(aq)}$
11. $Hg(C_2H_3O_2)_2 + Al \rightarrow$ $Al(C_2H_3O_2)_3 + Hg^{+2}$
12. $NaBr + I_2 \rightarrow$ NR
13. $HBr + Fe^{+2} \rightarrow$ $FeBr_2 + H_2$
14. $Ca(OH)_2 + H_3PO_4 \rightarrow$ $Ca_3(PO_4)_{2\,(s)} + HOH_{(l)}$
15. $PtCl_4 + F_2 \rightarrow$ $PtF_4 + Cl_2$

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Oxidation-Reduction Reactions Quiz

1. Determine the oxidation number of the elements in each of the following compounds:

Compound	Element 1	Element 2	Element 3
MnO_4^{-1}	+7	-2	
SO_3^{-2}	+4	-2	
$Cr(OH)_4$	+4	-2	+1

2. Identify each half reaction as either an **oxidation (O)** or **reduction (R)** reaction.

a. $Fe^{+2} \rightarrow Fe^{+3}$ oxidation

b. $Cu^{+2} \rightarrow Cu$ reduction

c. $\overset{+7}{CrO_4^{-1}} \rightarrow \overset{+4}{CrO_2}$ reduction

d. $\overset{+7}{S_2O_8^{-2}} \rightarrow \overset{+6}{SO_4^{-2}}$ reduction

3. Identify the substance being oxidized and reduced in each of the following reactions:

a. $\overset{0}{Na} + \overset{0}{Cl_2} \rightarrow \overset{+1\ -1}{NaCl}$ Na oxidized, Cl reduced

b. $\overset{+1\ -2\ +1\ -2\ 0}{\underset{+5}{KNO_3} \rightarrow \underset{+3}{KNO_2} + O_2}$ O oxidized, N reduced

c. $\overset{+1\ -2\ +1\ -2\ 0\ +2\ +1\ -2}{\underset{+5}{H_2S + HNO_3} \rightarrow S + \underset{-2}{NO} + H_2O}$ S oxidized, N reduced

Chemical Reactions Test Practice Honors Chemistry

Name: _____ Date: _____

1. Which is an example of a chemical reaction?

A. nails rusting B. glass melting

C. sugar dissolving D. alcohol vaporizing

2. The following equations represent chemical reactions.

Chemical Reactions

1	$2Na + 2H_2O \rightarrow NaOH + H_2$
2	$H_2 + O_2 \rightarrow H_2O$
3	$Mg + Cl_2 \rightarrow MgCl_2$
4	$NaOH + MgCl_2 \rightarrow NaCl + MgOH$

Which equation shows that the total mass during a chemical reaction stays the same?

A. 1 B. 2 C. 3 D. 4

3. $2CO + O_2 \rightarrow 2CO_2$

If the above reaction takes place inside a sealed reaction chamber, then which of these procedures will cause a decrease in the rate of reaction?

A. raising the temperature of the reaction chamber

B. increasing the volume inside the reaction chamber

C. removing the CO_2 as it is formed

D. adding more CO to the reaction chamber

4. A catalyst can speed up the rate of a given chemical reaction by

A. increasing the equilibrium constant in favor of products.

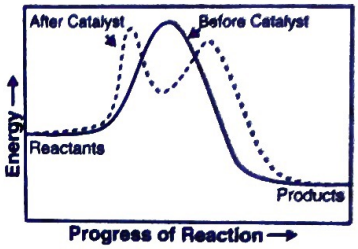
B. lowering the activation energy required for the reaction to occur.

C. raising the temperature at which the reaction occurs.

D. increasing the pressure of reactants, thus favoring products.

5. Which reaction diagram shows the effect of using the appropriate catalyst in a chemical reaction?

A.



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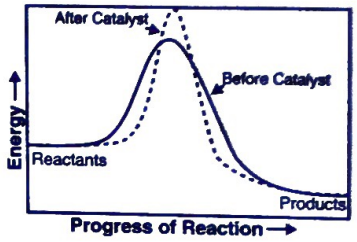

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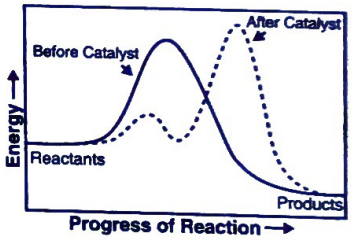

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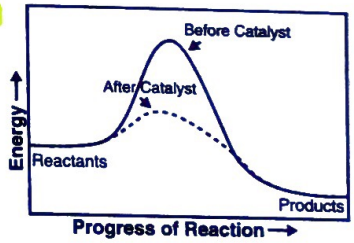


6. $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

This chemical equation represents the combustion of propane. When correctly balanced, the coefficient for water is

A. 2. B. 4. C. 8. D. 16.

7. Which of the following is a balanced equation for the combustion of ethanol (CH_3CH_2OH)?

A. $CH_3CH_2OH + 3O_2 \rightarrow CO_2 + 2H_2O$

B. $CH_3CH_2OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

C. $CH_3CH_2OH + O_2 \rightarrow 2CO_2 + 3HO$

D. $CH_3CH_2OH + 2O_2 \rightarrow 3CO_2 + 2H_2O$

8. _____ $NH_3(g)$ + _____ $O_2(g)$ → _____ $N_2(g)$ + _____ $H_2O(g)$

When the reaction above is completely balanced, the coefficient for NH_3 will be

A. 2. B. 3. C. 4. D. 6.

9. Which of the following processes involving cola represents a chemical change?

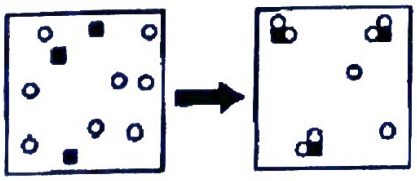
A. Liquid cola freezing into solid form

B. Ice cubes melting and changing into liquid water in a glass of cola

C. Water droplets condensing on the outside of a glass of cold cola

D. Carbonic acid in cola changing into carbon dioxide and water

10. The reaction of element X (▪) with element Y (O) is represented in the following diagram:



Which equation properly describes the reaction between X and Y?

A. $3X + 8Y \rightarrow X_3Y_8$ B. $3X + 6Y \rightarrow X_3Y_6$

C. $X + 2Y \rightarrow XY_2$ D. $3X + 8Y \rightarrow 3XY_2 + 2Y$

11. A balanced chemical equation reflects the idea that the mass of the products

A. is greater than the mass of the reactants.

B. is less than the mass of the reactants.

C. equals the mass of the reactants.

D. is not related to the mass of the reactants.

12. $2Na(s) + Cl_2(g) \rightarrow 2NaCl(s)$

s = solid

g = gas

The equation represents a chemical change because _____.

A. it is balanced

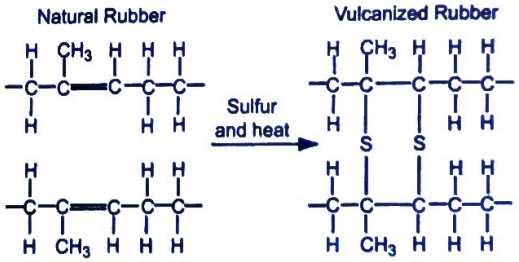
B. the product is solid

C. a new substance is produced

D. there are two substances on the reactant side

13. The tires on most cars are not made of natural rubber because it becomes brittle in the cold and sticky in the heat. Instead, natural rubber is vulcanized by adding sulfur and heat, making it stronger and more elastic. This process is represented chemically in the diagram below.

Vulcanization Process

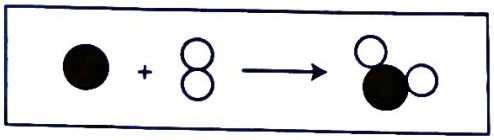


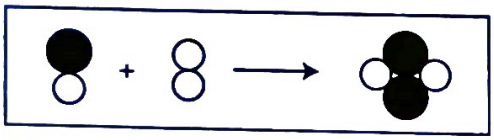
The complete combustion or burning of **natural rubber** will produce _____.

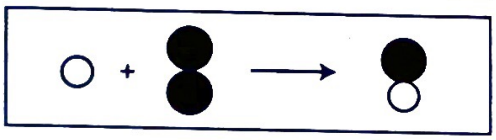
A. hydrogen and oxygen B. oxygen and water

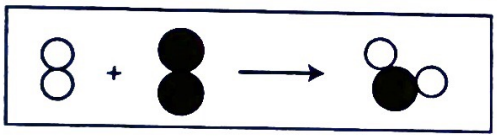
C. hydrogen gas and water D. carbon dioxide and water.

14. The law of conservation of mass can be demonstrated by a chemical reaction. Which of the following models of a chemical reaction *best* represents the law of conservation of mass?

A. 

B. 

C. 

D. 

15. In the chemical reaction shown below, all of the HCl and Zn will react to form H_2 and $ZnCl_2$.

Reactants				Products		
$2HCl$	+	Zn	$\longrightarrow$	H_2	+	$ZnCl_2$
hydrochloric acid (liquid)		zinc (solid)		hydrogen (gas)		zinc chloride (solid)

Which of the following statements describes the result of this reaction?

A. The hydrogen gas will have a mass of zero.

B. The zinc chloride will have less mass than the zinc.

C. The mass of the products will equal the mass of the reactants.

D. The mass of the hydrogen atoms will decrease in the products.

16. Copper in the compound $CuSO_4$ can be isolated in the following reaction with iron.

$Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

What type of reaction is shown above?

A. decomposition
B. synthesis
C. single displacement
D. double displacement

17. A student heated a 10 g sample of a compound in an open container. A chemical reaction occurred. The mass of the sample was measured again and found to be less than before. Which of the following explains the change in mass of the sample?

A. The heat caused the compound to become less dense.

B. The reaction gave off more heat than was added.

C. Some of the lighter atoms were converted to energy.

D. One of the reaction products was a gas.

18. Which of the following chemical reactions is a decomposition reaction?

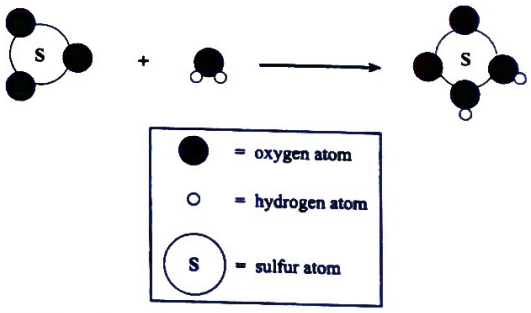
A. $BaCO_3 \rightarrow BaO + CO_2$

B. $2Ca + O_2 \rightarrow 2CaO$

C. $3Br_2 + 2FeI_3.2FeBr_3 + 3I_2$

D. $MgCl_2 + H_2SO_4.MgSO_4 + 2HCl$

19. The figure below represents a reaction.



What type of reaction is shown?

A. synthesis
B. decomposition
C. single displacement
D. double displacement

20. Which of the following chemical equations is balanced correctly?

A. $C_6H_6 + O_2 \rightarrow 2CO_2 + 3H_2O$

B. $CS_2 + 3Cl_2 \rightarrow CCl_4 + S_2Cl_2$

C. $B_2O_3 + 2C \rightarrow B_4C + CO$

D. $Cl_2 + NaI \rightarrow 2NaCl + I_2$

21. Under certain conditions, solid magnesium (Mg) and solid sulfur (S) can combine and form magnesium sulfide (MgS). The oxidation-reduction reaction is shown below.

$Mg(s) + S(s) \rightarrow MgS(s)$

Which of the following is the oxidation number for Mg in MgS in this reaction?

A. +1 B. −1 C. +2 D. −2

22. A balanced equation is shown below.

$C_6H_{12}O_6(\ell) \rightarrow 2C_2H_5OH(\ell) + 2CO_2(g)$

Which of the following statements correctly compares the mass of the reactant with the mass of the products in this equation?

A. The mass of the reactant is half the mass of the products.

B. The mass of the reactant is twice the mass of the products.

C. The mass of the reactant is one-fourth the mass of the products.

D. The mass of the reactant is the same as the mass of the products.

23. Methane gas burns in the presence of oxygen to form water vapor and carbon dioxide. The balanced equation for this reaction is below.

$CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$

Which of the following is the oxidation number of carbon in CO_2?

A. −2 B. 0 C. +2 D. +4

24. Hydrogen peroxide decomposes according to the equation below.

$2H_2O_2(aq) \rightarrow O_2(g) + 2H_2O(l)$

Which of the following actions will slow down the rate of this reaction?

A. adding a catalyst

B. adding more H_2O_2

C. decreasing the temperature

D. removing O_2 that is produced

25. The reaction below shows carbon monoxide burning in oxygen.

$2CO + O_2 \rightarrow 2CO_2$

What is the change in the oxidation number of carbon for this reaction?

A. +2 to +1 B. +2 to +4 C. +4 to +1 D. +4 to +2

26. When pure N_2O_5 is heated under certain conditions, O_2 and NO_2 are produced. What type of reaction is this?

A. combustion B. decomposition

C. double displacement D. synthesis (combination)

27. Which of the following equations represents the law of conservation of mass?

A. $H_2O - H_2 + O_2$ B. $2H + 2O - 2H_2O$

C. $2H_2O - 2H_2 + O_2$ D. $H_2 + O_2 - H_2O + H_2O_2$

28. A chemical reaction produces two new substances, and each product has a mass of 25 grams. What was the total mass of the reactants?

A. 25 grams B. 50 grams

C. 75 grams D. 100 grams

29. Which equation represents a double replacement reaction?

A. $2KClO_3 \rightarrow 2KCl + 3O_2$

B. $CaBr_2 + Na_2CO_3 \rightarrow CaCO_3 + 2NaBr$

C. $Zn + S \rightarrow ZnS$

D. $2Li + FeBr_2 \rightarrow 2LiBr + Fe$

30. Solutions of lead(II) nitrate and potassium dichromate are mixed. The solution turns cloudy and yellow. Solid yellow particles fall to the bottom of the beaker. Which statement *best* describes this reaction?

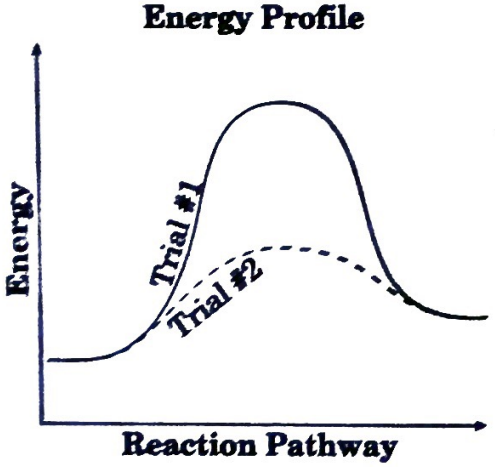
A. A precipitate formed.

B. A gas formed.

C. The reaction is exothermic.

D. The reaction is endothermic.

31. This graph represents the change in energy for two laboratory trials of the same reaction.



Which factor could explain the energy difference between the trials?

A. Heat was added to trial #2.

B. A catalyst was added to trial #2.

C. Trial #1 was stirred.

D. Trial #1 was cooled.

32. Which equation represents a single replacement reaction that can occur?

A. $F_2 + 2NaCl \rightarrow 2NaF + Cl_2$

B. $Cl_2 + 2NaF \rightarrow 2NaCl + F_2$

C. $Ca + 2NaCl \rightarrow CaCl_2 + 2Na$

D. $Zn + 2NaF \rightarrow ZnF_2 + 2Na$

33. What products are formed when the metal potassium is added to water?

A. K and H_2O

B. KOH and H_2O

C. K_2O and H_2

D. KOH and H_2

34. What is the oxidation number of the chromium atom in the $Cr_2O_7^{2-}$ ion?

A. −6 B. −4 C. +4 D. +6

35. Consider this oxidation-reduction reaction: SKIP

$16H^+ + 2MnO_4^- + 5Sn^{2+} \rightarrow 5Sn^{4+} + 2Mn^{2+} + 8H_2O$

Which represents the oxidation half-reaction?

A. $Sn^{4+} + 2e^- \rightarrow Sn^{2+}$

B. $Mn^{4+} + 4e^- \rightarrow Mn^{2+}$

C. $Sn^{2+} \rightarrow Sn^{4+} + 2e^-$

D. $Mn \rightarrow Mn^{2+} + 2e^-$

36. This balanced equation represents a chemical reaction:

$3Ag + 4HNO_3 \rightarrow 3AgNO_3 + NO + 2H_2O$

Which substance undergoes reduction?

A. Ag^0 B. H^+ C. N^{5+} D. O^{2-}

37. Consider this chemical equation:

$2AgBr(s) + energy \rightarrow 2Ag(s) + Br_2(l)$

Which is true about the reaction?

A. Silver is reduced.

B. Bromine is reduced.

C. Silver loses electrons.

D. Bromine gains electrons.

38. Butane (C_4H_{10}) is used as the fuel in many portable lighters. When butane is completely combusted in oxygen, what is the coefficient for the water produced in the properly balanced equation that represents the reaction?

A. 10 B. 8 C. 6 D. 4

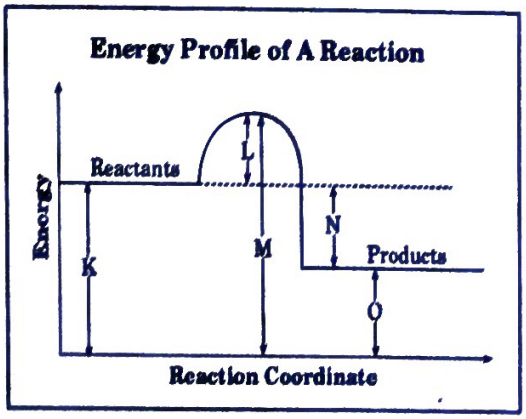
39. Consider the following balanced equation: SKIP

$5CO + I_2O_5 \rightarrow 5CO_2 + I_2$

Which substance is the oxidizing agent?

A. CO B. I_2O_5 C. CO_2 D. I_2

40. Use the graph below to answer the following question(s).



In the graph, which of the following is represented by the letter L?

A. reaction heat

B. progress of reaction

C. catalytic effect

D. activation energy

41. On the graph, which dimension would be changed if the rate of reaction were to be altered by a catalyst?

A. K B. L C. N D. O

42. What is the oxidation number of sulfur in $BaSO_4$?

A. −2 B. 0 C. +1 D. +6

43. Consider this incomplete chemical equation:

$$Ba + CuCl_2 \rightarrow$$

What are the products of this equation?

A. $BaCl_2$ and $CuCl_2$ B. $BaCuCl_2$ and Ba

C. $BaCl_2$ and Cu D. BaCu and Cl_2

44. This balanced equation represents a chemical reaction.

$$2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(g)$$

What type of chemical reaction is represented by the equation?

A. combustion B. decomposition

C. double replacement D. single replacement

45. This balanced equation represents a chemical reaction using palladium, Pd, as a catalyst.

$$CO_2(g) + H_2O(l) \xrightarrow{(Pd)} H_2CO_3(l)$$

Without palladium the reaction is slow and produces low concentrations of product. How does the palladium increase the speed of the reaction?

A. The palladium reacts with the water.

B. The palladium lowers the activation energy.

C. The palladium purifies the carbon dioxide.

D. The palladium increases the reaction temperature.

46. Which pair of substances will likely undergo a single replacement reaction?

A. Na and $BaCl_2$ B. Zn and $BaCl_2$

C. Ca and $BaCl_2$ D. K and $BaCl_2$